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'GRASSLANDS WANA' COCKSFOOT- AN IMPROVED GRASS SUITABLE FOR HILL COUNTRY

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Abstract

Cocksfoot *(Dactylis glomerata* L.) is the second most commonly sown grass after ryegrass (*Lolium* spp.) in New Zealand. Some characteristics restricting its performance in pastures have been improved in a new variety 'Grasslands Wana' cocksfoot, released in 1980. A series of trials at Taupo, Woodville, Central Wairarapa and Eastern Southland showed that under sheep grazing Wana can be established as the dominant component of the sward. It was concluded that Wana has potential as both a dry and moist hill country pasture grass and particularly in dry environments may have advantages over the species currently present.

Keywords: 'Grasslands Wana' cocksfoot, hill country, pasture species, dryland.

INTRODUCTION

Cocksfoot *(Dactylis glomerata* L.) is used throughout New Zealand and is the most commonly sown grass after ryegrass (*Lolium perenne* L.) (Harris 1968, Sangakkara *et al.* 1982). It has several characteristics contributing to its popularity, however, these are offset by disadvantages which have restricted its more widespread use.

Among the advantages of cockfoot over ryegrass are greater tolerance to drought (Evans 1976), moderate fertility (Davis 1975, Langer 1977) and grass grub (*Costelytra zealandica*) (Radcliffe 1971, East *et al.* 1980). Cocksfoot may therefore be of greatest advantage in hill country environments where such limitations can be severe. Cocksfoot usually shows greater summer and autumn production, but lower spring and winter production than ryegrass (Vartha 1975, 1977).

Disadvantages of cocksfoot include sensitivity to severe grazing (Brougham 1960, Lambert 1968) and treading (Edmond 1964), reduced palatability when rank (Langer 1977) and slow establishment (Sangakkara & Roberts 1982). Probably as a consequence of these effects and stem rust, a survey of Manawatu pastures showed that during summer the percentage occurrence of cocksfoot was rarely more than 5% (Lancashire & Latch 1969). Sensitivity to grazing and treading has probably restricted cocksfoot use in hill country where it may be of benefit. The satisfactory and often superior establishment of cocksfoot compared to ryegrass in South Island (SI) hill and high country (Cullen 1966, Douglas 1966, White 1972, Radcliffe *et al.* 1977) suggests cocksfoot establishment may be sensitive to competition for light, as in dense pastures, rather than competition for nutrients, as in open pastures of SI high country.

A recent breeding programme (Rumball 1982) has resulted in a cocksfoot cultivar, 'Grasslands Wana', (released in 1980) which is characteristically different than previous cultivars (principally 'Grasslands Apanui', released in 1953). Rumball (1982) describes Wana as being low crowned and more prostrate than Apanui and in swards gives a dense, even cover whereas Apanui tends to become clumpy. Rumball (1982) therefore predicted Wana would be more persistent under severe grazing. This has been confirmed in small plots where, under continuous grazing, the percentage yield contribution and tiller density of Wana was greater than for the erect varieties Apanui and 'Grasslands Kara' (Lancashire & Brock 1983).

In hill country where mechanical cultivation is often not possible Wana can be established by oversowing. At one site in Kaikohe, Wana was established by hand sowing (8 kg/ha) after a cut and burn operation (K. Betteridge *pers. comm.*). At Ballantrae Wana was satisfactorily introduced into existing pasture by oversowing at 14 kg/ha (Chapman, Campbell & Harris, in prep.) Its initial germination was slower than for Nui ryegrass, however, seedling numbers 50 days after sowing were similar. Establishment was enhanced by herbicide application which temporarily reduced competition from the resident pasture. Growth rates of Wana in the first six months after sowing are slower than for ryegrass (Lancashire & Brock 1983).

Additional attributes of Wana are a) its high competitive ability which can reduce the growth of barley grass (Popay *et al.* 1981), b) resistance to stem and stripe rust (Rumball 1982) resulting in increased summer feed quality (Lancashire & Brock 1983), c) tolerance to grass grub (East et *al.* 1982), d) greater *in vitro* digestibility than Apanui (Rumball 1982), and e) its potential use as a safe, non-ryegrass staggers pasture (Lancashire 1983). The successful seed production from Wana has been described by Brown *et al.* (1983). These factors combine to suggest Wana has potential in NZ hill country where little use has been made of cocksfoot pastures.

MATERIALS & METHODS

In a series of hill country trials established at "Aratiatia" (Taupo), "Ballantrae" (Woodville), "Rawhiti" (Central Wairarapa) and "Fairplace" (Eastern Southland) the performance of Wana cocksfoot was compared with Nui ryegrass and the resident pasture. The Aratiatia and Rawhiti trials are sited in dry hill country and experience regular summer droughts, while the Ballantrae and Fairplace trials are sited on sunny faces in moist hill country with occasional summer droughts. Site details are as follows:

Aratiatia (Lands and Survey) – 5 km NE of Taupo. Annual rainfall 1200 mm. The soil is of the Taupo hill series – one of the driest of the pumice hill soils (W.J.M. Rijske *pers. comm.*). The low stocked resident pasture was Yorkshire fog dominant. Sown in spring 1982, Wana 40 kg/ha and Nui 60 kg/ha.

Ballantrae (DSIR) 5 km SW of Woodville. Annual rainfall 1400 mm. The soil is a Mangamahu steepland soil formed on silty sandstone (related to the yellow brown earths) with the resident pasture being red fescue and browntop dominant. Sown in autumn 1981, Wana 60 kg/ha and Nui 75 kg/ha.

Rawhiti Station – 20 km E of Masterton. Annual rainfall 900-1000 mm. The soil type is a Kourarau/Waimarama silt loam (central yellow brown earth) with the resident pasture being ryegrass dominant. Sown in autumn 1980, Wana 50 kg/ha and Nui 70 kg/ha.

Fairplace Station – 30 kg WNW of Gore. Annual rainfall 1100 mm. The soil is a yellow grey earth with the resident vegetation being fescue-silver short tussock and other grasses such as browntop, sweet vernal and Yorkshire fog. Sown in autumn 1981, Wana 8 kg/ha and Nui 20 kg/ha (Meurk & Turner 1985).

Since the objective of these trials was to compare the productivity and persistence of varying pasture types rather than their short term establishment characteristics, fertiliser (up to 500 kg superphosphatelha and 100 kg urea/ha), herbicides and in some cases high sowing rates, cultivation and/or stock treading were used to ensure establishment. Grasses were sown with 'Grasslands Huia' white clover (*Trifolium repens* L.) (3 kg/ha) and Mt Barker and Woogenellup subterranean clovers (*Trifolium subterraneum* L.) (4-8 kg/ha). Resident plots were undisturbed, except for stock treading at Aratiatia and Rawhiti, but subsequently received the same management as for Wana and Nui pastures. Grazing was with sheep, 6-8 times annually, when pastures had 1000-2500 kg DM/ha on offer. Plots ($\geq$100m²) were individually fenced and the intensity of grazing was kept approximately constant between plots by varying the number of sheep used.

Results for 1983-84 only are presented.

RESULTS AND DISCUSSION

Productivity

At the drier Aratiatia and Rawhiti sites, total annual yields from Wana pastures were similar to yields of Nui and resident pastures, while at the moister sites Ballantrae and Fairplace, the total yields from Wana were less than from Nui but still greater than from the resident pastures (Figure 1). This is consistent with the ability of cocksfoot to performn relatively better than ryegrass in drier environments (Levy 1970, Langer 1977).

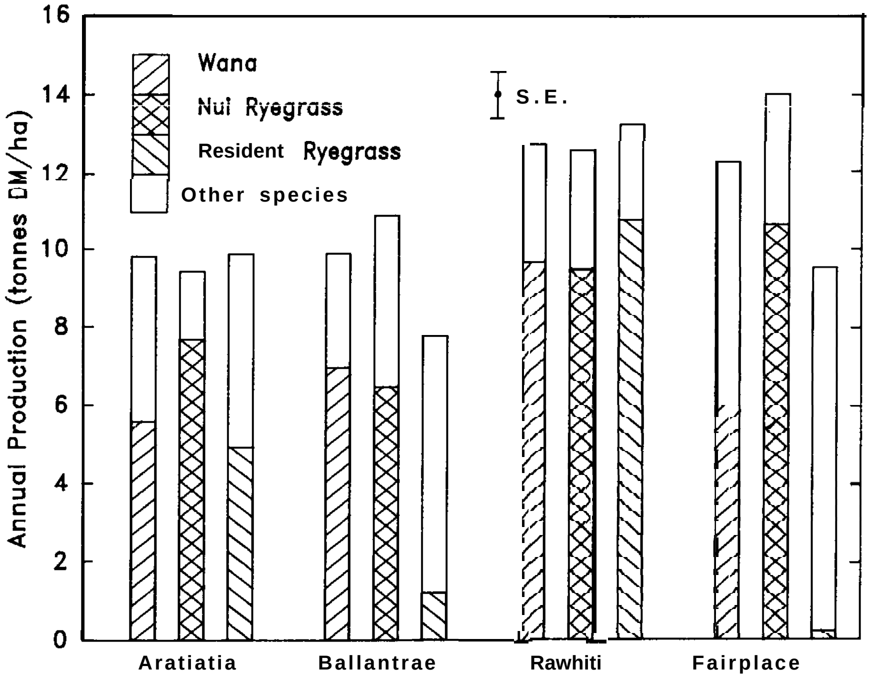

Figure 1: Comparison of annual total and component production of Wana, Nui and resident ryegrass pastures at four sites for 1983-84 (tonnes DM/ha).

Seasonal production data (Table 1) showed winter growth rates of Wana and Nui pastures to be similar, while during spring (early spring at Rawhiti) growth rates of Nui exceeded those of Wana. At the wetter Ballantrae and Fairplace sites Nui growth rates exceeded those of Wana during summer and autumn, while at the drier sites, growth of Wana in summer (Aratiatia) and autumn (Rawhiti) exceeded Nui and compensated for lower production during spring. These patterns of growth are similar to those observed in a comparison between Ruanui ryegrass and Apanui cocksfoot (Vartha 1975).

The percentage contributions of Wana to total yield (Table 1) show that at all 4 sites Wana was the major component of the sward. The relatively low contribution at Fairplace is probably attributable to a lower seeding rate at this site (8 kg/ha) and the low contribution in spring at Aratiatia is likely attributable to the relatively young age of these pastures. These data show clearly however, that under sheep grazing in hill country, Wana cocksfoot can survive as the dominant component of the pasture. This supports previous recommendations (Lambert 1968, Vartha 1975) that cocksfoot be included in pasture mixes.

Table 1: SEASONAL GROWTH RATES (kg DM/ha/day) FROM WANA AND NUI PASTURES AT THE 4 TRIALS SITES (1983-84). (Percentage contributions of sown grasses to total yield are in parenthesis).

	Aratiatia		Rawhiti		Ballantrae		Fairplace	
Season	Wana	Nui	Wana	Nui	Wana	Nui	Wana	Nui
Winter	na[1]	na	20 (71)	20 (89)	16 (81)	11 (81)	13	13
Early Spring	16 (46)	28 (84)	39 (68)	47 (83)	20 (69)	24 (70)	25	32
Late Spring	31 (55)	47 (82)	65 (72)	60 (84)	63 (60)	71 (54)	50 (43)	60 (74)
Summer	29 (61)	20 (65)	50 (62)	65 (70)	47 (69)	55 (53)	52 (44)	61 (57)
Autumn	17 (67)	20 (84)	35 (76)	27 (76)	12 (79)	18 (55)	43 (47)	49 (69)

[1]na = not available

Persistence

One feature of Wana to emerge from these trials is its high competitive ability. At all sites Wana has increased its contribution to total yield over time to become the dominant species of the pasture. In the most recently sown pasture (Aratiatia) Wana increased from 21% to 61% of total yield between the 6th and 18th month after sowing. Similarly at the oldest site (Rawhiti) Wana's annual contribution in successive years from sowing was 41%, 65%, 73% and 76%. The development of Wana pastures clearly continues after 12 months and improvements in the Wana contribution can be expected after 24 months.

The vigour of Wana was also apparent in its ability to suppress "weed" species in the pasture (Rumball 1982). At Rawhiti the percentage of weeds in Wana pastures (0.7% of annual yield) was significantly lower than for Nui (2.3%) and resident (1.5%) pastures ($P \leqslant 0.05$). Similar effects were observed at Ballantrae (1.3%, 4.6% and 4.4% weeds for the respective pastures, $P \leqslant 0.05$). There were significantly fewer Scotch thistle (*Cirsium vulgare* (Savi) Ten.) plants at Rawhiti in Wana than in Nui or resident pastures in August 1983 (17, 50 and 85 plants/100m^2 respectively).

Rumball (1982) suggested the competitive ability of Wana can act to the detriment of white clover, however, evidence from these trials was inconclusive. At Rawhiti the amount of white clover in Wana swards (1%) was almost one-third of that in Nui swards (2.7%) in the 4th year after sowing, however, levels of 7·10% white clover in the set stocked resident pasture outside the trial suggest the Huia sown was under stress in the environment and less able to compete with Wana. Production from subterranean clover (which can be as much as white clover) was not significantly different between Wana and Nui pastures (1.4% and 1.9% respectively, $P \leqslant 0.05$). At the 3 remaining sites percentages of white clover in Wana pastures were similar to those for Nui. Subterranean clover was not important at the Ballantrae and Fairplace sites. The important role of white clover in fixing nitrogen in New Zealand pastures makes a closer investigation of the relationship between Wana and pasture legumes imperative. At Whatawhata a Pawera red clover-Wana mixture yielded 26% more than a Huia white clover-ryegrass mixture (MacFarlane 1983).

Tiller density

Tiller counts of Wana, Nui and/or Resident ryegrass are shown in Table 2 for Rawhiti and Aratiatia and Table 3 for Ballantrae and Fairplace. Overall, Wana tiller

Table 2: GRASS TILLER AND WHITE CLOVER GROWING POINT DENSITY (number/m')

Site and Sampling date	Wana	Clover	Nui	Clover	Resident ryegrass	Clover
Rawhiti						
26.5.83	6410	229	7335	704	14416	409
22.8.83	11663	85	16645	535	21093	263
31.1.84	5627	9	5813	119	8800	314
17.4.84	7181	34	7079	687	10373	823
Aratiatia						
4.3.83	2828	1148	4319	902	1513	342
30.6.83	3313	1960	4321	1410	4220	394
30.3.84	4810	1255	5015	1440	5560	1053
23.5.84	4877	1689	6363	1919	6168	1173

densities at Rawhiti and Aratiatia were lower than for Nui but in more recent counts from Rawhiti Wana and Nui counts were similar. At Ballantrae and Fairplace (Table 3) counts have been made on different slope classes. Tiller densities for Wana and Nui were comparable on the flats at Ballantrae, however, Wana performed relatively better on the slopes. At Fairplace Wana tiller density was spread more evenly across different slope classes than for Nui. This suggests Wana shows a greater ability than ryegrass to colonise the steeper, drier areas. In a different trial on flat ground under heavy set stocking at Palmerston North, tiller densities for Wana, Apanui and Saborto cocksfoots and Ruanui ryegrass were 14,000, 5,900, 2,900 and 12,400 respectively.

Table 3: SOWN GRASS TILLER DENSITIES (number/m²) ON STEEP (>25°) MEDIUM (15°-25°) AND FLAT (<15°) SLOPES

Site and Sampling date	Wana Steep	Wana Medium	Wana Flat	Nui Steep	Nui Medium	Nui Flat
Ballantrae						
5.9.83	6484	na[1]	8047	3191	na	6502
8.5.84	2754	na	6987	969	na	7166
Fairplace						
May 1984	2553	3518	5708	2977	6737	10151

[1]na = not available

In-vitro Digestibility (IVD)

Of 5 analyses throughout the year (3 from Ballantrae and 2 from Rawhiti), 4 found Wana was of lower IVD than ryegrass (mean = 64.1% vs 70.5%). Such a difference could be attributed to a faster loss of quality in long, herbage for Wana than for ryegrass, which is implied by Langer (1977). Since this difference could influence animal production, information on the effects of grazing management on Wana quality and the implications for stock performance is needed.

CONCLUSION

The conclusion from these trials is that 'Grasslands Wana' cocksfoot has potential as both a dry and moist hill country pasture grass and, particularly in dry environments, may have advantages over the species currently present. Under sheep grazing it can be established as the dominant component of swards and it forms a pasture of similar density to ryegrass. Though not necessarily producing more than ryegrass annually, the greater production from Wana during dry seasons makes it a useful pasture species during these periods. Two areas requiring particular attention at present are the long term persistence of white clover in Wana pastures and the effect of grazing management on pasture quality.

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